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☐ 1. Document ID: US 20030011792 A1

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L4: Entry 1 of 38 File: PGPB Jan 16, 2003

PGPUB-DOCUMENT-NUMBER: 20030011792
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030011792 A1

TITLE: PRINTER CONTROL BASED ON HEAD ALIGNMENT

PUBLICATION-DATE: January 16, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
NOYES, STEVEN	FOUNTAIN VALLEY	CA	US	
MASUMOTO, KAZUYUKI	IRVINE	CA	US	
YAMADA, AKITOSHI	IRVINE	CA	US	
HIRABAYASHI, HIROMITSU	IRVINE	CA	US	

US-CL-CURRENT: 358/1.4; 358/1.15, 358/1.8

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Ima

☐ 2. Document ID: US 6650436 B1

L4: Entry 2 of 38 File: USPT Nov 18, 2003

DOCUMENT-IDENTIFIER: US 6650436 B1
TITLE: Automatic sheet feed control

Application Filing Date (1):
19990414

Detailed Description Text (599):
FIG. 70 illustrates process steps for bleed reduction in which print driver 84 makes a selection of color tables based on the printer status. Thus, in step S7001, print driver 85 obtains printer status temperature TenvL. Step S7002 tests the printer status temperature against a fixed predetermined amount, preferably 32.degree. C. If the printer status temperature TenvL is not less than or equal to the fixed predetermined temperature, then flow branches to step S7003 in which a color correction table is selected based on the higher possibility for ink bleed. Specifically, step 7003 selects color Table 2 which limits the amount of ink ejected by printer 10 for high temperatures. In this regard, it is inferred that high temperatures also involve high humidities, which increase overall ink drying time.

Detailed Description Text (603):

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In the embodiment shown in FIG. 70, different color tables were selected by print driver 84 based on the printer status temperature TenvL. It is also possible for print driver 84 to modify values in a look-up table, rather than to select between different look-up tables. FIG. 72 illustrates this alternative embodiment.

Detailed Description Text (604):
Thus, in step S7200, print driver 84 obtains printer status temperature TenvL. Next, in step 7201, a standard printer color correction table is loaded into memory. Step S7202 tests the printer status temperature against a fixed predetermined threshold such as 32.degree. C. If the printer status temperature is less than or equal to the fixed threshold, then no modifications are made to the loaded printer color correction table. On the other hand, if the printer status temperature exceeds the fixed predetermined threshold, then flow branches to step S7203 where print driver 84 modifies the values in the color correction look-up table so as to reduce the possibility of ink bleed. Suitable modifications are modifications to values so as to obtain the values shown in FIG. 71.

Current US Original Classification (1):
358/1.9

Current US Cross Reference Classification (4):
358/1.1

Current US Cross Reference Classification (5):
358/1.18

☐ 3. Document ID: US 6621594 B1

L4: Entry 3 of 38 File: USPT Sep 16, 2003

DOCUMENT-IDENTIFIER: US 6621594 B1
**** See image for Certificate of Correction ****
TITLE: Printed data correcting device, printed data correcting method, and software recording medium on which printed data correcting program is recorded

Application Filing Date (1):
19990503

Detailed Description Text (46):
Upon selection of the print processing, the operating system 21a starts the printer driver 21b. Since a primary color correction lookup table is not available when the printer driver 21b is started initially, single-color patch printing is performed at step S205 following a judgment at step S200. On the other hand, a patch pattern printed using the reference print head 31a is prepared separately, and it is compared with a patch pattern printed using the print head 31a equipped on each printer 31. At step S210, each corresponding value is entered.

Detailed Description Text (49):
In case that the printer driver 21b is started initially, the above-mentioned printing and entry operations are carried out and then color conversion table write processing is performed at step S240. That is, a degree of adjustment for each color in the color conversion table is reduced according to equation (1) or (2), and then each conversion value attained through calculation is rewritten into the color conversion table.

Current US Original Classification (1):
358/3.1

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Current US Cross Reference Classification (1):
358/3.21

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWMC | Draw Desc | Ima

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☐ 4. Document ID: US 6611356 B1

L4: Entry 4 of 38 File: USPT Aug 26, 2003

DOCUMENT-IDENTIFIER: US 6611356 B1
TITLE: Color data conversion method, color data conversion apparatus, storage medium, device driver and color conversion table

Application Filing Date (1):
19990621

Detailed Description Text (106):
The printer driver 33 includes a color: conversion table 34 which can be generated using the method according to the present invention, and refers to the color conversion table 34 when generating color data to be outputted to the color picture output device 32 from color data on its display. The color conversion table 34 can store the color data in the portable storage medium 36 as a data file or as a part of a program file similar to the printer driver 33, and can distribute them by being downloaded from the information provider 37 through a communication network, such as the Internet, etc. In this case, the color conversion table 34 can be read from the portable storage medium 36 by the storage medium read device 38, and installed in the printer driver 33. Alternatively, the information provider 37 can be accessed through the communication interface 35, only the color conversion table 34 can be down-loaded from the information provider 37 through the network 39 and the communication interface 35, and the color conversion table 34 can be used by installing it in the printer driver 33.

Current US Original Classification (1):
358/1.9

Current US Cross Reference Classification (1):
358/500

Current US Cross Reference Classification (2):
358/518

Current US Cross Reference Classification (3):
358/525

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWMC | Draw Desc | Ima

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☐ 5. Document ID: US 6594028 B1

L4: Entry 5 of 38 File: USPT Jul 15, 2003

DOCUMENT-IDENTIFIER: US 6594028 B1
** See image for Certificate of Correction **
TITLE: Status-based control over printer

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Application Filing Date (1):
19990414

Detailed Description Text (599):
FIG. 70 illustrates process steps for bleed reduction in which print driver 84 makes a selection of color tables based on the printer status. Thus, in step S7001, print driver 85 obtains printer status temperature TenvL. Step S7002 tests the printer status temperature against a fixed predetermined amount, preferably 32.degree. C. If the printer status temperature TenvL is not less than or equal to the fixed predetermined temperature, then flow branches to step S7003 in which a color correction table is selected based on the higher possibility for ink bleed. Specifically, step 7003 selects color Table 2 which limits the amount of ink ejected by printer 10 for high temperatures. In this regard, it is inferred that high temperatures also involve high humidities, which increase overall ink drying time.

Detailed Description Text (603):
In the embodiment shown in FIG. 70, different color tables were selected by print driver 84 based on the printer status temperature TenvL. It is also possible for print driver 84 to modify values in a look-up table, rather than to select between different look-up tables. FIG. 72 illustrates this alternative embodiment.

Detailed Description Text (604):
Thus, in step S7200, print driver 84 obtains printer status temperature TenvL. Next, in step 7201, a standard printer color correction table is loaded into memory. Step S7202 tests the printer status temperature against a fixed predetermined threshold such as 32.degree. C. If the printer status temperature is less than or equal to the fixed threshold, then no modifications are made to the loaded printer color correction table. On the other hand, if the printer status temperature exceeds the fixed predetermined threshold, then flow branches to step S7203 where print driver 84 modifies the values in the color correction look-up table so as to reduce the possibility of ink bleed. Suitable modifications are modifications to values so as to obtain the values shown in FIG. 71.

Current US Original Classification (1):
358/1.15

Current US Cross Reference Classification (5):
358/1.1

Current US Cross Reference Classification (6):
358/1.13

Current US Cross Reference Classification (7):
358/1.9

CLAIMS:

1. A print driver executable on computing equipment connectable to a printer driven by the print driver over a bi-directional interface, said print driver comprising: a querying segment to query the printer to obtain current status over the bi-directional interface, the current status including printer temperature, the querying segment querying in response to initiation of a print job on the computing equipment; a modifying segment for modifying default functionality, which includes a default color correction table, of said print driver in accordance with the printer temperature, a modified color correction table results in an amount of ink ejection by the printer that is different from an ink ejection amount of the default color correction table; a data generating segment for generating print data in accordance with the modified color correction table; and a sending segment for sending the print data generated by said data generating segment to the printer over the bi-directional interface.

☐ 6. Document ID: US 6512595 B1

L4: Entry 6 of 38 File: USPT Jan 28, 2003

DOCUMENT-IDENTIFIER: US 6512595 B1
**** See image for Certificate of Correction ****
TITLE: Data processing apparatus, data processing method, and medium

Application Filing Date (1):
19990426

Detailed Description Text (50):
As has been described above, the method of generating print data by the printer driver according to the present embodiment is controlled by a data control system, capable of processing data which is generated by rendering software operated in a data processing apparatus and rendering data in rendering bitmap space of a designated tone. The printer driver comprises: means for designating a tone in rendering bitmap space; means for registering a color palette table consisting of monochrome values having linear tones and color values evenly arranged in a color space; means for converting a color attribution value included in an image/graphics/character rendering command to a monochrome value; means for converting the monochrome value to a color palette number; and means for generating print data based on the color palette number and the image/graphics/character rendering command. By virtue of the above configuration, color image data is converted to monochrome data and transferred to a printer without causing excessive data loss and high quality printing is enabled.

Detailed Description Text (52):
Still further, the aforementioned advantages can also be attained by having means for performing color conversion process on the values in the color palette table which is registered in the data control system by the printer driver; means for registering the converted values in association with the color palette table; means for performing the foregoing conversion process for the number of colors registered in the color palette, only at the time of starting a print job or at the time of changing color conversion parameters; and means for generating print data to be transferred to a printer by looking up a palette value which has been converted from a value in the bitmap space after rendering process.

Current US Original Classification (1):
358/1.9

Current US Cross Reference Classification (1):
358/1.1

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWMC | Draw Desc | Ima

☑ 7. Document ID: US 6466332 B1

L4: Entry 7 of 38 File: USPT Oct 15, 2002

DOCUMENT-IDENTIFIER: US 6466332 B1
TITLE: BLACK COLOR GENERATION AMOUNT DETERMINING METHOD IN BLACK PRINTING, A BLACK COLOR GENERATION AMOUNT DETERMINING APPARATUS IN BLACK PRINTING, A MEDIA HAVING RECORDED THEREON A BLACK COLOR GENERATION AMOUNT DETERMINING PROGRAM IN BLACK PRINTING

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Application Filing Date (1):
19980121

Detailed Description Text (50):
When receiving via the operating system 21a RGB tone color data of the dot matrix image in step ST10 as described above, the printer driver 21b performs color conversion from RGB to CMYK with reference to the aforesaid color conversion table for printing. It is not always necessary for the color conversion table for printing to possess a conversion result as to all of the colors consisting of combinations of RGB. If there is no corresponding conversion value, the conversion result may be obtained by performing an interpolation calculation. Further, it may occur that the tone conversion is firstly performed corresponding in number to tones of the color conversion table for printing based upon the consideration that the color conversion table for printing has less tone number compared to the data before conversion, whereupon the color conversion table for printing is referred after the tone conversion. In the tone conversion in this case, it is necessary to utilize an error diffusion method to prevent color difference from making great.

Detailed Description Text (56):
When the printing processing is selected, the operating system 21a operates the printer driver 21b. The printer driver 21b inputs the RGB tone color data as the image data at step ST10, refers the color conversion table for printing having the structure shown in FIG. 8 from the RGB tone value at step ST20 and obtains Cout, Mout, Yout, Kout as the conversion result. Thereafter, the binarization is performed at step ST30, whereby the binary tone CMYK data is outputted to the printer 31 at step ST40.

Current US Original Classification (1):
358/1.9

Current US Cross Reference Classification (1):
358/515

Current US Cross Reference Classification (2):
358/518

Current US Cross Reference Classification (3):
358/529

☑ 8. Document ID: US 6439682 B1

L4: Entry 8 of 38 File: USPT Aug 27, 2002

DOCUMENT-IDENTIFIER: US 6439682 B1
TITLE: Printing method, printing apparatus, and recording medium

Application Filing Date (1):
19990301

Detailed Description Text (7):
When the applications program 95 issues a printing instruction, the printer driver 96 in the computer 90 receives image data from the applications program 95 and converts the input image data into signals processible by the printer 22, that is, multi-valued signals for the respective colors, cyan, magenta, yellow, and black. In the example of FIG. 2, the printer driver 96 includes a resolution conversion module 97, a color

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correction module 98, a color correction table LUT, a halftone module 99, and a rasterizer 100.

Current US Cross Reference Classification (1):
358/1.9

☐ 9. Document ID: US 6404509 B1

L4: Entry 9 of 38 File: USPT Jun 11, 2002

DOCUMENT-IDENTIFIER: US 6404509 B1
TITLE: Color correction device

Application Filing Date (1):
19980331

Detailed Description Text (19):
The color correction at step S130 is substantially performed by such operation of the printer driver as forming a color correction look-up table upon its activation as well as incorporating the color correction look-up table into a color conversion look-up table. Specifically, the printer driver executes at first a reading of the uneven data from the PROM area shown in step S13. The main body of the execution here is a CPU of the computer 21, such procedure itself is a printer driver program recorded in the hard disc 22 and the CPU suitably reads a necessary program to develop it on the RAM for execution.

Detailed Description Text (23):
At the subsequent step S15, values of the color conversion look-up table are rewritten by using the color correction look-up table. Accordingly, the correction into C'M'Y'K' data foreseeing the deviation of output characteristics of the printer 31 is performed simultaneous with the conversion of the color space to CMYK by referring to the color conversion look-up table based upon the RGB data. Briefly, it can be said that the operation in which the printer driver performs the color conversion by using the look-up table prepared in advance at steps S14 and S15 as well as its hardware construction construct the color correction means.

Detailed Description Text (39):
Specifically, it can be said that steps S21 to S24 construct the deviation receiving means and that the operation in which the printer driver performs the color conversion by using the look-up table prepared in advance at steps S25 and S26 as well as its hardware construction construct the color correction means.

Detailed Description Text (52):
After the selected result is inputted to the computer 21 from the key board 23 at step S35, a color correction look-up table is also determined in accordance with the finally selected ID to be set to the printer driver so as to be incorporated into a color conversion look-up table used for the color conversion by the printer driver.

Detailed Description Text (65):
Upon activating the color correction program, the computer system communicates with the printer 31 to read the data recorded in the PROM area of the print head 31a via the printer controller 31e and the print head controller 31b (step S13). This data is the one showing the actually measured density as described above. If this data is above or below the reference value, a color correction look-up table is formed (step S14), and then, a value of a color conversion look-up table is rewritten by using this color correction look-up table (step S15) to terminate this program. Therefore, the printer driver is required to be installed before this operation. However, this program is terminated only

after the color correction look-up table is formed, while the value of the color conversion look-up table may be rewritten by using the color correction look-up table upon activating the printer driver.

Detailed Description Text (66):
On the other hand, by rewriting the color conversion look-up table, the printer driver inputs the color image data at step S110 shown in FIG. 13 to refer the color conversion look-up table at step S120 based upon this color image data when the printer driver is activated at a time of executing the printing operation from the application. The CMYK data referred to by the color conversion look-up table has already been rewritten by foreseeing the deviation in output characteristics in the printer 31, with the result that the read CMYK data is the data in which the color correction is finished at step S130.

Detailed Description Text (72):
If the color conversion look-up table is rewritten in this way, the printer driver inputs the color image data at step S210 shown in FIG. 20 for simultaneously performing the color correction at step S220 and color conversion at step S230 by referring to the rewritten color conversion look-up table when the printer driver is activated upon executing the printing operation from the application, as in the same manner of the former case. When binarization is made at the subsequent step S240 to cause the obtained data to be printed at step S250, color deviation which is expected to occur due to the deviation of the print head unit 31a1 of the printer 31 does not occur.

Detailed Description Text (74):
In the aforesaid embodiment, the timing for forming the color correction look-up table to be incorporated into the color conversion look-up table is the time when the printer driver is activated. This timing is not absolute, but it is desirable to suitably control this executing timing in order to accurately perform the color correction. Explained hereinafter is an embodiment for accomplishing this object.

Detailed Description Text (76):
The install program is recorded on a program storing medium such as CD-ROM or the like to be distributed. After the printer 31 is connected to the computer 21, the CD-ROM is set to CD-ROM drive 24. Thereafter, the install program is executed as the application for developing the printer driver or color conversion look-up table on the hard disc 22. It is to be noted that it may be introduced via the floppy disc drive 25 and modem 26 as described above.

Detailed Description Text (81):
Specifically, when the printer driver performs the color conversion thereafter, the color correction is performed by referring to the rewritten color conversion look-up table. Further, the color conversion look-up table having such information is formed in the process of install, whereby it can be said that the color correction look-up table and color conversion look-up table compose the color correction data as well as that each procedure of step S520 to S540 constructs the color correction data producing means. It is to be noted that the install program executes this color correction data producing means. The install program constructs setting means.

Detailed Description Text (89):
On the other hand, if the printer driver is activated for the printing operation, it is judged whether the color correction look-up table is present or not at step S630 through the judgement at step S610. If the color correction look-up table has been formed in the install program, it means that the color correction data has been produced before the printing operation. However, the case where the install program does not form the color correction look-up table means that the color correction data is not produced upon the printing operation, so that the aforesaid subroutine for receiving the deviation is executed at step S640, a color correction look-up table is formed at step S650 and a color conversion look-up table is formed at step S660. The procedures at steps S650 and 660 may be the same as those as steps S530 and S540.

Detailed Description Text (97):
On the other hand, by rewriting the color conversion look-up table in this way, the

printer driver refers to the color conversion look-up table based upon this color image data at step S670 shown in FIG. 39 when activated upon executing the printing operation from the application. The CMYK data referred to in the color conversion look-up table has already been rewritten by foreseeing the deviation of output characteristics of the printer 31, whereby the read CMYK data is the data in which the color correction and color conversion are simultaneously terminated, which means that the color correction is executed.

Detailed Description Text (101):
If the color conversion look-up table is rewritten in this way, color correction and color conversion are simultaneously performed by referring to the color conversion look-up table which is rewritten at step S670 of the printer driver when the printer driver is activated upon executing the printing operation from the application, as in the same manner of the former case. When binarization is made at the subsequent step S680 to cause the obtained data to be printed at step S690, color deviation which is expected to occur due to the deviation of the print head unit 31a1 of the printer 31 does not occur.

Detailed Description Text (102):
The case where the install program does not rewrite the color conversion look-up table as described above means that the color correction look-up table is not formed. In this case, it is judged whether the color correction look-up table is present or not at step S630 before the color conversion when the printer driver is initially activated. If it is not present, the color correction data is formed at steps S640 to S660. Therefore, the color correction data is surely formed before the color conversion at step S670.

Current US Original Classification (1):
358/1.9

☑ 10. Document ID: US 6404507 B1

L4: Entry 10 of 38 File: USPT Jun 11, 2002

DOCUMENT-IDENTIFIER: US 6404507 B1
TITLE: Printer carriage control

Application Filing Date (1):
19990414

Detailed Description Text (646):
FIG. 70 illustrates process steps for bleed reduction in which print driver 84 makes a selection of color tables based on the printer status. Thus, in step S7001, print driver 85 obtains printer status temperature TenvL. Step S7002 tests the printer status temperature against a fixed predetermined amount, preferably 32.degree. C. If the printer status temperature TenvL is not less than or equal to the fixed predetermined temperature, then flow branches to step S7003 in which a color correction table is selected based on the higher possibility for ink bleed. Specifically, step 7003 selects color Table 2 which limits the amount of ink ejected by printer 10 for high temperatures. In this regard, it is infer-red that high temperatures also involve high humidities, which increase overall ink drying time.

Detailed Description Text (650):
In the embodiment shown in FIG. 70, different color tables were selected by print driver 84 based on the printer status temperature TenvL. It is also possible for print driver 84 to modify values in a look-up table, rather than to select between different look-up tables. FIG. 72 illustrates this alternative embodiment.

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Detailed Description Text (651):
Thus, in step S7200, print driver 84 obtains printer status temperature TenvL. Next, in step 7201, a standard printer color correction table is loaded into memory. Step S7202 tests the printer status temperature against a fixed predetermined threshold such as 32.degree. C. If the printer status temperature is less than or equal to the fixed threshold, then no modifications are made to the loaded printer color correction table. On the other hand, if the printer status temperature exceeds the fixed predetermined threshold, then flow branches to step S7203 where print driver 84 modifies the values in the color correction look-up table so as to reduce the possibility of ink bleed. Suitable modifications are modifications to values so as to obtain the values shown in FIG. 71.

Current US Original Classification (1):
358/1.5

Current US Cross Reference Classification (1):
358/1.18

☑ 11. Document ID: US 6364452 B1

L4: Entry 11 of 38 File: USPT Apr 2, 2002

DOCUMENT-IDENTIFIER: US 6364452 B1
TITLE: Color printing using multiple inks

Application Filing Date (1):
19990414

Detailed Description Text (655):
FIG. 70 illustrates process steps for bleed reduction in which print driver 84 makes a selection of color tables based on the printer status. Thus, in step S7001, print driver 85 obtains printer status temperature TenvL. Step S7002 tests the printer status temperature against a fixed predetermined amount, preferably 32.degree. C. If the printer status temperature TenvL is not less than or equal to the fixed predetermined temperature, then flow branches to step S7003 in which a color correction table is selected based on the higher possibility for ink bleed. Specifically, step 7003 selects color Table 2 which limits the amount of ink ejected by printer 10 for high temperatures. In this regard, it is inferred that high temperatures also involve high humidities, which increase overall ink drying time.

Detailed Description Text (659):
In the embodiment shown in FIG. 70, different color tables were selected by print driver 84 based on the printer status temperature TenvL. It is also possible for print driver 84 to modify values in a look-up table, rather than to select between different look-up tables. FIG. 72 illustrates this alternative embodiment.

Detailed Description Text (660):
Thus, in step S7200, print driver 84 obtains printer status temperature TenvL. Next, in step 7201, a standard printer color correction table is loaded into memory. Step S7202 tests the printer status temperature against a fixed predetermined threshold such as 32.degree. C. If the printer status temperature is less than or equal to the fixed threshold, then no modifications are made to the loaded printer color correction table. On the other hand, if the printer status temperature exceeds the fixed predetermined threshold, then flow branches to step S7203 where print driver 84 modifies the values in the color correction look-up table so as to reduce the possibility of ink bleed. Suitable modifications are modifications to values so as to obtain the values shown in FIG. 71.

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Current US Cross Reference Classification (2):
358/521

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Ima

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☐ 12. Document ID: US 6356358 B1

L4: Entry 12 of 38 File: USPT Mar 12, 2002

DOCUMENT-IDENTIFIER: US 6356358 B1
TITLE: Dot recording method and dot recording device

Application Filing Date (1):
19981202

Detailed Description Text (4):
The computer 90 is provided therein with CPU, RAM, and ROM (not shown), and an applications program 95 runs under a specific operating system. A video driver 91 and a printer driver 96 are incorporated in the operating system, and final color image data FNL of the applications program 95 are output through these drivers. The applications program 95 used for, for example, retouch an image, reads an image from the scanner, execute a prescribed processing, and displays the image on the CRT display 93 through the video driver 91. When the applications program 95 outputs a printing instruction, the printer driver 96 receives image information from the applications program 95 and converts the input image information to printing signals for the printer 22. (The printing signals are binarized signals for the respective colors of C, M, Y, and K.) In the example of FIG. 1, the printer driver 96 includes: a rasterizer 97 for converting the color image data processed by the applications program 95 to dot-based image data; a color correction module 98 for executing color correction on the dot-based image data according to the ink colors of C, M, and Y used by the printer 22 and the calorimetric characteristics of the printer 22; a color correction table CT referred to by the color correction module 98; a halftone module 99 for generating halftone image data, which represents image density in a particular area by on/off of ink in each dot, from the color-corrected image data; and a mode selection writing module 110 for writing mode selection information, which will be described later, into a memory in the color printer 22.

Current US Original Classification (1):
358/1.7

Current US Cross Reference Classification (4):
358/1.12

Current US Cross Reference Classification (5):
358/1.13

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Ima

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☑ 13. Document ID: US 6351320 B1

L4: Entry 13 of 38 File: USPT Feb 26, 2002

DOCUMENT-IDENTIFIER: US 6351320 B1
TITLE: Memory-saving printer driver

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Application Filing Date (1):
19990423

Drawing Description Text (3):
FIG. 2. illustrates a schematic block diagram illustrating a method of generating a memory-saving printer driver having a minimized number of color correction lookup tables, in accordance with the present invention;

Drawing Description Text (6):
FIG. 5 illustrates a schematic circuit diagram of the printer driver of the present invention including a User Interface segment and a minimized number of color correction lookup tables segment; and

Detailed Description Text (8):
FIG. 2 illustrates one aspect of the present invention for generating a memory-saving printer driver including a minimized number of color correction lookup tables. In order to convert from one color space to another, a calibration signal generator 50 develops a number of calibration signals for causing a printer 52 to generate a plurality of color calibration test sheets 54, 56, 58, 60, 62, and 64. Each of the calibration test sheets are generated by printing a large number, on the order of 1,000 (10 cyan densities by 10 magenta densities by 10 yellow densities) patches of colors distributed throughout printer color space for each of a plurality of media types which will be used in the printer of FIG. 1. These media types include plain paper, premium coated paper, transparency, high resolution paper, high resolution glossy paper, and transfer media. Other CMY combinations of interest, for instance, skin tones, preferred graphics tones, or other memory colors may also be included.

Detailed Description Text (11):
In addition, chroma or hue is often manipulated in order to change the appearance of the output images depending on the type of image being recorded. For instance, a photographic image is typically printed with a different chroma or hue than a graphics image. Consequently, when one considers the number of available print media in an ink jet printer environment as well as the variety of images and types of images being printed thereby, the amount of memory space required for the storage of the conventionally generated color correction tables becomes extremely large. Therefore, the present invention advantageously is directed to a memory-saving printer driver having a minimized the number of color correction tables for generating quality images printed by a liquid ink printer.

Detailed Description Text (15):
Thus it was found that for the subset "k" of different media types where there Is not much color shift, a common lookup table generated for all the "k" media types using data from that one of the subset "k" media types having the greatest dynamic color range of DR.sub.k-1. In order words, where "k" is two, as on HL4, then a common lookup table generated using data from the media having DR.sub.2 (which is greater than DR.sub.1) will be used for both media types on that hue line. Where "k" is three, a common lookup table generated using data from the media type having a dynamic color range of DR.sub.2, will be mapped and used for the DR.sub.2 and DR.sub.1 media types. Similarly, a common lookup table using data from the DR.sub.3 media type, can be mapped and used for DR.sub.1, DR.sub.2 and DR.sub.3. In general therefore, each media-type basis color correction lookup table for each of the plural and variable number "K" of different media type subsets is developed from color correction data for one of the plural and variable number "K" having a color saturation dynamic range of at least greater than DR.sub.2. As such, a memory-saving printer driver can be created in accordance with the present invention, having a minimized number "N" of color correction lookup tables as above such that "N" is significantly less than "M". Therefore, for any given plural number "M" of different media types (where different subsets "k" of the number "M" each have a common or coincident hue line), using a common lookup table for the subset "k" (where "k" is greater than 1), clearly minimizes the number "N" of lookup tables required, and hence reduces the amount of printer or system memory required for storing color correction lookup table.

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Current US Original Classification (1):
358/1.9

Current US Cross Reference Classification (1):
358/1.16

Current US Cross Reference Classification (2):
358/518

CLAIMS:

3. The memory-saving printer driver of claim 2, wherein said each media-type basis color correction lookup table for each said plural and variable number "K" of different media types is developed from color correction data for one of said plural and variable number "K" having a color saturation dynamic range at least greater than said DR.sub.2.

10. The color printing system of claim 8, wherein said memory-saving print driver includes two tone reproduction curve lookup tables, each of said tone reproduction curve lookup tables being selectable as a function of a selection of one of the plurality of different media types.

☐ 14. Document ID: US 6344908 B1

L4: Entry 14 of 38 File: USPT Feb 5, 2002

DOCUMENT-IDENTIFIER: US 6344908 B1
**** See image for Certificate of Correction ****
TITLE: Image processing system for processing achromatic color image data

Application Filing Date (1):
19970328

Detailed Description Text (9):
Programs for executing the color processes which are performed by the host computer as shown in flowcharts of FIGS. 5A, 5B, 5C, 7A and 7B have been stored in the program ROM 1302. Font data or the like to convert document data which was edited and formed into a character pattern displayed on the CRT 10 at the time of a document process has been stored in a font ROM 1301. Various data (for example, directory information, a printer driver table, and the like) which is used upon execution of the color processes or the like has been stored in a data ROM 1303.

Current US Original Classification (1):
358/529

Current US Cross Reference Classification (1):
358/538

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☐ 15. Document ID: US 6313925 B1

L4: Entry 15 of 38 File: USPT Nov 6, 2001

DOCUMENT-IDENTIFIER: US 6313925 B1
TITLE: System, method, and program for saving toner/ink in a color printer without sacrificing image quality

Application Filing Date (1):
19980617

Detailed Description Text (28):
Once the above tables have been generated, the color transform table file can then be sent and loaded into a printer controller or loaded onto a storage medium such as a diskette. If the color transform table is stored on a storage medium, the color transform table can be permanently stored into the printer controller via the storage medium, or it can be loaded into the printer controller by the print driver as required by the print job.

Current US Original Classification (1):
358/1.9

Current US Cross Reference Classification (5):
358/1.13

Current US Cross Reference Classification (6):
358/504

Current US Cross Reference Classification (7):
358/518

Current US Cross Reference Classification (8):
358/527

Current US Cross Reference Classification (9):
358/529

☐ 16. Document ID: US 6304671 B1

L4: Entry 16 of 38 File: USPT Oct 16, 2001

DOCUMENT-IDENTIFIER: US 6304671 B1
TITLE: Image processing apparatus using an offset correction table enabling interpolation to be performed without conditional jumps

Application Filing Date (1):
19981006

Detailed Description Text (7):
In the example of FIG. 2, the printer driver 96 includes a rasterizer 97 that converts the color image data processed by the applications program 95 into dot-based image data, a color correction module 98 that causes the dot-based image data to be subjected to color correction according to the ink colors C, M, and Y used by the image output

apparatus (the printer 22 in this embodiment) and the calorimetric characteristics of the printer 22, and a color correction table CT and an offset correction table OT referred to by the color correction module 98. The printer driver 96 is further provided with a halftone module 99 that generates halftone image data, which express the density in a specific area by the existence or non-existence of ink in each dot unit, from the color-corrected image data.

Current US Cross Reference Classification (1):
358/523

☐ 17. Document ID: US 6281984 B1

L4: Entry 17 of 38 File: USPT Aug 28, 2001

DOCUMENT-IDENTIFIER: US 6281984 B1
TITLE: Enhanced system, method and program for converting an externally defined four dimensional colorant (CMYK) into an equivalent four dimensional colorant defined in terms of the four inks (C'M'Y'K') that are associated with a given printer

Application Filing Date (1):
19970325

Detailed Description Text (22):
FIG. 2 illustrates a flow diagram of the process for creating a color transform table. First, greyscale patches are printed of each Cp,Mp,Yp,Kp at predetermined intervals such as at 50 equally spaced intervals, for a total of 200, step 201. The L*a*b* of each patch is measured, step 202. Plots are made for each set and intervals into N segments (N=8 in the preferred embodiment) are determined. The best linear fit in each interval for L* as well as a* and b* are sought in this step, step 203. The data is entered into a computer program, step 204. A mapping is made between various printed greyscale values of K' and externally defined K values based on corresponding L* values, step 205. Then (CMY(p))k' patches with various percents of each color (0-100% as determined in step 201) at varying percents of K' that have been mapped to externally defined K values are printed, step 206. The L*a*b* values of each of these (CMY(p))k'patches at each K' value are measured, step 207. This data is then entered into a computer program, step 208. A look up table is formed of CMY at various K values to (C'M'Y')k' at various K'values, step 211. A color transform table file is created, step 212. The color transform table file can then be sent and loaded into a printer controller 213 or loaded onto a storage medium such as a diskette, step 214. If the color transform table is stored on a storage medium, the color transform table can be permanently stored into the printer controller via the storage medium, or it can be loaded into the printer controller by the print driver as required by the print job, steps 214-217.

Current US Original Classification (1):
358/1.9

Current US Cross Reference Classification (1):
358/529

☐ 18. Document ID: US 6266165 B1

h e b b g e e e f e fc ef b e

L4: Entry 18 of 38 File: USPT Jul 24, 2001

DOCUMENT-IDENTIFIER: US 6266165 B1
TITLE: Method for morphing n-dimensional data using a scattered data transformation

Application Filing Date (1):
19980930

Detailed Description Text (70):
Once the output color space is defined by the method of the present invention, the set of output points is used to generate a look-up table that preferably will be used by the printer software driver in the host computer that provides print data to a color printer. While the final output space could be defined for a possible set of colors having the dimensions 256.times.256.times.256, for a total of 16 million potential colors, it is preferred to significantly reduce the number of possible color values that will define the look-up table. When actual color data is presented to the printer driver program at the host computer, it is then preferred that all of the color values of the print job be interpolated between nearby defined colors from the look-up table (i.e., the set of input points and output points), and then printed on the color printer using the color output space defined by these output point in the look-up table.

Current US Original Classification (1):
358/520

☐ 19. Document ID: US 6243174 B1

L4: Entry 19 of 38 File: USPT Jun 5, 2001

DOCUMENT-IDENTIFIER: US 6243174 B1
TITLE: Image processing device, color printing device, image processing method and medium recording image processing program

Application Filing Date (1):
19971021

Detailed Description Text (15):
Now, referring to FIG. 2(a), the printer driver 21b is constituted by a rasterizer 21b1 where the application 21d cuts out a scanning range of the print heads 31a in the printer 31 from image data formed by a predetermined screen unit, a color conversion unit 21b2 for converting grey scale data of RGB into grey scale data of CMY in reference to a color conversion table with respect to each pixel of the dot matrix data, a grey scale converting unit 21b3 for converting the grey scale data of CMY into binary data and a resolution comparing unit 21b4 for inquiring a pixel size designated by the application 21d in accordance with a function in respect of the operating system 21a and comparing the pixel size with a pixel size of the printer 31. Incidentally, the printer driver 21b is constituted by software and respective constituent elements are also constituted by software. Further, these elements scan the print heads 31a in respect of the printer 31 in accordance with a procedure shown by FIG. 8 and outputs print data of printable dot matrix data.

Current US Original Classification (1):
358/530

h e b b g e e e f e fc ef b e

Current US Cross Reference Classification (1):
358/448

Current US Cross Reference Classification (2):
358/518

☐ 20. Document ID: US 6226101 B1

L4: Entry 20 of 38 File: USPT May 1, 2001

DOCUMENT-IDENTIFIER: US 6226101 B1
TITLE: Dot recording using specific schemes at the end of recording medium

Application Filing Date (1):
19980827

Detailed Description Text (4):
FIG. 2 is a block diagram conceptually illustrating the functions of software related to the printing process. In the computer 90, an applications program 95 is activated under a specific operating system. The operating system includes a video driver 91 and a printer driver 96. The printer driver 96 processes image data supplied from the applications program 95 and outputs final color image data FNL to the printer 22. The applications program 95 used to, for example, retouch an image, reads an image from the scanner 12 and executes predetermined processing on the input image, while displaying the image on the CRT display 21 via the video driver 91. When the applications program 95 outputs a printing instruction, the printer driver 96 receives image information from the applications program 95 and converts the input image information to printing signals for the printer 22; the printing signals are binarized signals for the respective colors C, M, Y, and K. In the example of FIG. 2, the printer driver 96 includes a rasterizer 97 for converting the color image data processed by the applications program 95 to dot-based image data, a color correction module 98 for executing color correction on the dot-based image data according to the ink colors C, M, and Y used by the printer 22 and the calorimetric characteristics of the printer 22, a color correction table CT referred to by the color correction module 98, and a halftone module 99 for generating halftone image data, which represents image density by the existence or non-existence of ink in each dot in a specific area, from the color-corrected image data.

Current US Original Classification (1):
358/1.8

Current US Cross Reference Classification (1):
358/1.9

Current US Cross Reference Classification (2):
358/502

☐ 21. Document ID: US 6215561 B1

L4: Entry 21 of 38 File: USPT Apr 10, 2001

h e b b g e e e f e fc ef b e

DOCUMENT-IDENTIFIER: US 6215561 B1
TITLE: Image processing apparatus and image processing method

Application Filing Date (1):
19971209

Detailed Description Text (11):
The following describes a concrete structure of the image processing apparatus 30. The block diagram of FIG. 2 shows a structure with a computer 90 that realizes the image processing apparatus 30. The computer 90 includes conventional elements (not shown), such as a CPU, a RAM, and a ROM, and an applications program 95 is executed under a predetermined operating system. A video driver 91 and a printer driver 96 are incorporated in the operating system, and the resulting color image data FNL are output from the applications program 95 via these drivers 91 and 96. The applications program 95, which carries out, for example, retouch of an image, reads an image with the scanner 12 and displays the image on a CRT display 93 via the video driver 91 while carrying out a predetermined process with respect to the scanned image. In response to a printing command issued by the applications program 95, the printer driver 96 of the computer 90 receives image information from the applications program 95 and converts the image information to signals printable by the printer 22 (that is, binarized signals for C, M, and Y). In the example of FIG. 2, the printer driver 96 includes a rasterizer 97 for converting the color image data processed by the applications program 95 to image data of the dot unit, a color correction module 98 for making the image data of the dot unit subjected to color correction according to the ink colors C, M, and Y used by the image output unit 20, such as the printer 22, and its colorimetric characteristics, a color correction table CT referred to by the color correction module 98, and a halftone module 99 for generating halftone image information, which expresses densities in a specific area by the existence or non-existence of ink in each dot unit, based on the color-adjusted image information.

Detailed Description Text (29):
The color correction table CT referred to by the color correction module 98 in the computer 90 is a color table, in which a three-dimensional color space consisting of the three colors R, G, and B is divided into lattices as shown in FIG. 6. The color correction table CT is read from, for example, a hard disk, and stored in the RAM of the computer 90, while the printer driver 96 is incorporated into the operating system. Tone-adjusted data of the respective colors C, M, and Y obtained by converting the tone data of R, G, and B regarding each lattice point are stored at each lattice point in the color table. This makes the color of an input color original read with the scanner 12 identical with the color of an output color image printed on a printing medium with the color printer 22.

Current US Original Classification (1):
358/1.9

Current US Cross Reference Classification (1):
358/1.1

☑ 22. Document ID: US 6211970 B1

L4: Entry 22 of 38 File: USPT Apr 3, 2001

DOCUMENT-IDENTIFIER: US 6211970 B1
TITLE: Binary printer with halftone printing temperature correction

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Application Filing Date (1):
19981124

Detailed Description Text (117):
To prevent visible color shifts across 98% of the addressable colors, it is required to control the swath-swath temperature variation to 5C. A 10C line to line variation in temperature will cause visible color shifts in about 65% of the addressable colors. Multiple color tables may be simulated with this model and applied to the printer driver--print head temperature control system to make this swath-swath limit less restrictive.

Current US Original Classification (1):
358/1.9

Current US Cross Reference Classification (4):
358/1.8

Current US Cross Reference Classification (5):
358/502

Current US Cross Reference Classification (6):
358/521

Current US Cross Reference Classification (7):
358/534

☐ 23. Document ID: US 6068361 A

L4: Entry 23 of 38 File: USPT May 30, 2000

DOCUMENT-IDENTIFIER: US 6068361 A
TITLE: Method and apparatus for multiple drop error diffusion in a liquid ink printer

Application Filing Date (1):
19971030

Current US Cross Reference Classification (2):
358/3.03

Current US Cross Reference Classification (3):
358/502

CLAIMS:

12. The color printing system of claim 11, wherein said print driver comprises a signal lookup table, including a plurality of threshold reference signals and a plurality of drop signals, each of said plurality of threshold reference signals associated with one of said plurality of drop signals.

☐ 24. Document ID: US 6061501 A

L4: Entry 24 of 38 File: USPT May 9, 2000

DOCUMENT-IDENTIFIER: US 6061501 A
**** See image for Certificate of Correction ****
TITLE: System, method and program for converting an externally defined four colorant (CMYK) into an equivalent four dimensional colorant defined in terms of the four inks (C'M'Y'K') that are associated with a given printer

Application Filing Date (1):
19970325

Detailed Description Text (17):
of each of these (CMY)p patches at Kp=0 are measured, step 207. This data is then entered into a computer program, step 208. Look up tables are formed of CMY to C'M'Y' and K to K', step 211. A color transform table, (CMYK)-to-C'M'Y'K'), file is created, step 212. The color transform table file can then be sent and loaded into a printer controller 213 or loaded onto a storage medium such as a diskette, step 214. If the color transform table is stored on a storage medium, the color transform table can be permanently stored into the printer controller via the storage medium, or it can be loaded into the printer controller by the print driver as required by the print job, steps 214-217.

Current US Original Classification (1):
358/1.9

Current US Cross Reference Classification (1):
358/504

Current US Cross Reference Classification (2):
358/518

Current US Cross Reference Classification (3):
358/529

☐ 25. Document ID: US 5946454 A

L4: Entry 25 of 38 File: USPT Aug 31, 1999

DOCUMENT-IDENTIFIER: US 5946454 A
**** See image for Certificate of Correction ****
TITLE: Image enhancement during half-toning using low-pass and high-pass filtering

Abstract Text (1):
A printer driver employs multi-level dither to limit the size of a look-up table required for its color-correction operation. To suppress some of the resultant artifacts, a filter operation precedes the half-toning operation used to produce the printer input signal. The computation cost of the filter operation is modest because it uses an infinite-impulse-response filter.

Application Filing Date (1):
19970702

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Current US Original Classification (1):
358/1.9

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Ima

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☐ 26. Document ID: US 5872896 A

L4: Entry 26 of 38 File: USPT Feb 16, 1999

DOCUMENT-IDENTIFIER: US 5872896 A
** See image for Certificate of Correction **
TITLE: Continuous-tone ink reduction

Application Filing Date (1):
19960708

Detailed Description Text (51):
By the single real-time table-look-up operation 102, the printer driver performs color-fidelity correction, dot-gain compensation, and any ink-duty limiting not performed in a subsequent half-toning step 104. This results because the look-up table has been filled in an off-line operation that blocks 106 and 108 represent. Specifically, a revision sequence 106 that performs color-fidelity correction, dot-gain compensation, and possibly some other adjustment processes receives pixel values corresponding to all fifteen-bit look-up-table addresses that the multi-level-dithering operation 100 could potentially produce. The driver subjects the results to an ink-duty-reduction operation 108 that performs one or more of the ink-duty-reduction operations described above. The look-up table is filled with the resultant eight-bit-per-component values before any real-time source-image processing begins. The half-toning operation 104, which may include gating with a half-toning-operation-generated gating signal in the manner described above, generates outputs included in the printer commands.

Current US Original Classification (1):
358/1.9

Current US Cross Reference Classification (4):
358/1.1

Current US Cross Reference Classification (5):
358/1.18

Current US Cross Reference Classification (6):
358/296

Current US Cross Reference Classification (7):
358/518

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Ima

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☐ 27. Document ID: US 5799136 A

L4: Entry 27 of 38 File: USPT Aug 25, 1998

DOCUMENT-IDENTIFIER: US 5799136 A
TITLE: On-line ink-duty reduction

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Application Filing Date (1):
19960528

Detailed Description Text (51):
By the single real-time table-look-up operation 102, the printer driver performs color-fidelity correction, dot-gain compensation, and any ink-duty limiting not performed in a subsequent half-toning step 104. This results because the look-up table has been filled in an off-line operation that blocks 106 and 108 represent. Specifically, a revision sequence 106 that performs color-fidelity correction, dot-gain compensation, and possibly some other adjustment processes receives pixel values corresponding to all fifteen-bit look-up-table addresses that the multi-level-dithering operation 100 could potentially produce. The driver subjects the results to an ink-duty-reduction operation 108 that performs one or more of the ink-duty-reduction operations described above. The look-up table is filled with the resultant eight-bit-per-component values before any real-time source-image processing begins. The half-toning operation 104, which may include gating with a half-toning-operation-generated gating signal in the manner described above, generates outputs included in the printer commands.

Current US Original Classification (1):
358/1.9

Current US Cross Reference Classification (1):
358/3.13

Current US Cross Reference Classification (2):
358/3.17

Current US Cross Reference Classification (3):
358/534

☐ 28. Document ID: US 5795082 A

L4: Entry 28 of 38 File: USPT Aug 18, 1998

DOCUMENT-IDENTIFIER: US 5795082 A
TITLE: Printing system utilizing inks of different densities, cartridge used therefor, and method of recording images

Application Filing Date (1):
19970625

Detailed Description Text (49):
The structure of the second embodiment first specifies the densities (tone data) of cyan, magenta, and yellow required for realizing the hue of a target pixel, and then determines the recording ratios of dots by deep ink and light ink of each color, based on the correlation of tone data. In accordance with another possible application, the recording ratios of dots by deep ink and light ink of each color may be determined directly from RGB data of a target pixel in a printer driver. As shown in FIG. 23, for example, a rasterizer 297, a color correction/halftone module 299, and a look-up table 300 are arranged inside a printer driver 296. After the rasterizer 297 gives RGB data of each target pixel, the procedure of the modified example refers to the look-up table 300 and determines the recording ratios of light ink and deep ink for cyan and magenta and the recording ratio of yellow ink, directly based on the RGB data. FIGS. 24A and 24B show examples of the look-up table used for determining the recording ratios of dots by the

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light cyan ink C2 and the cyan ink C1 directly from the RGB data of a target pixel.

Current US Cross Reference Classification (3):
358/520

☐ 29. Document ID: US 5778160 A

L4: Entry 29 of 38 File: USPT Jul 7, 1998

DOCUMENT-IDENTIFIER: US 5778160 A
TITLE: Liquid ink printing system having region-dependent image processing

Application Filing Date (1):
19960924

Detailed Description Text (17):
Since a plurality of corresponding tag block portions are analyzed to determine whether or not color information is contained therein, a lookup table is established by either the host processor 50 under control of the print driver 58 or the tag block processor 70 to store indicating bits to indicate which of the tag block portions contain color information. Consequently, once any resulting bits are determined to be equal to 1 at step 106, a corresponding lookup table location is set to 1 at step 110. If, however, none of the resulting bits are equal to 1 at step 106, then the corresponding lookup table location is set to 0 at step 112 and as embodied in the lookup table 114 of FIG. 4. At step 116, if it is determined that all of the tag blocks have not been selected, then a new tag block is selected at step 93 and the previously described operations are repeated for the newly selected tag block. If, however, all of the tag blocks have been selected and thus analyzed, the lookup table locations in the lookup table 114 are checked at step 118 to determine if any lookup table locations indicate that the previously analyzed tag blocks include color information. If, yes, then at step 120 color processing is applied to only the tagged portions of the image. Once the color processing has been completed, then the document is printed at step 122. Of course, if none of the lookup table locations 118 were tagged or set to a one at step 118, then the document is printed at step 122 without the application of any additional color processing.

Current US Original Classification (1):
358/1.9

Current US Cross Reference Classification (2):
358/1.2

Current US Cross Reference Classification (3):
358/1.6

Current US Cross Reference Classification (4):
358/500

Current US Cross Reference Classification (5):
358/518

Current US Cross Reference Classification (6):
358/537

Current US Cross Reference Classification (7):
358/538

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☑ 30. Document ID: US 5699491 A

L4: Entry 30 of 38 File: USPT Dec 16, 1997

DOCUMENT-IDENTIFIER: US 5699491 A
TITLE: Printer driver having gamut-mapped colors

Abstract Text (1):
A color printer driver for a printer includes a reproduction look-up table (LUT) which stores CMY values for colors both in-gamut and out-of-gamut of the printer. For close-in out-of-gamut colors, the reproduction LUT stores perceptually matched CMY values whereas for far-out-of-gamut colors, the reproduction LUT stores saturation matched CMY values. CMY values for the out-of-gamut colors are obtained by a dual-cone gamut mapping technique in which an actual cone of N-cone arranged surfaces is defined so as to mimic the actual gamut of the printer, an ideal cone of M-cone arranged surfaces is defined so as to mimic an ideal gamut such as the gamut of a typical color monitor, a target out-of-gamut color is projected onto the actual cone and de-saturated until an in-gamut CMY value is obtained, the same target color is projected onto the ideal cone to obtain a fully-saturated CMY value, and a weighted average is obtained of the in-gamut CMY value and the fully-saturated CMY value, the weight being based on a measure of distance between the out-of-gamut target color and its projection onto the actual cone.

Application Filing Date (1):
19950615

Brief Summary Text (3):
The present invention pertains to a method and apparatus for building and using, in a printer driver or color management system, color look-up tables which determine the colors that the printer driver sends to a color printer in response to requests to print specific colors. The specific colors requested to be printed may include colors that are not printable, i.e., are not in the gamut of the color printer. For those colors in particular, the invention provides for gamut mapping of the unprintable colors to printable colors in such a way as to preserve both perceptual color reproduction and saturation color reproduction.

Brief Summary Text (14):
Thus, according to one aspect of the invention, a color printer driver for a printer includes a reproduction look-up table (LUT) which, for each of plural colors both in-gamut and out-of-gamut of the printer, stores color component values for printing by the printer. Means, responsive to a command to print a color, are provided for outputting color component values stored in the reproduction LUT in correspondence to the commanded color. For close-in out-of-gamut colors, the reproduction LUT stores perceptually matched color component values while for far-out-of-gamut colors, the reproduction LUT stores saturation matched color component values. For out-of-gamut colors between close-in out-of-gamut colors and far-out-of-gamut colors, the reproduction LUT stores weighted averages between a perceptual match and a saturation match.

Brief Summary Text (15):
In a further aspect of the invention, a color printer driver which outputs color component values for printing by a printer includes a reproduction look-up table (LUT) which, for each of plural colors both in-gamut and out-of-gamut of the printer, stores color component values for printing by the printer. Means, responsive to a command to print a color, are provided for outputting color component values stored in the reproduction LUT in correspondence to the commanded color. For out-of-gamut colors, the reproduction LUT stores color component values obtained by dual-cone gamut mapping in which an actual cone of N-cone arranged surfaces is defined which mimics an actual gamut

of the printer, in which an ideal cone of M-cone arranged surfaces is defined which mimics an ideal gamut, in which a target out-of-gamut color is projected onto the actual cone and de-saturated until in-gamut color component values are obtained, in which the same target color is projected onto the ideal cone to obtain fully-saturated color component values, and in which a weighted average is obtained of the in-gamut color component values and the fully-saturated color component values, weight being based on the distance between the projection onto the actual cone and the out-of-gamut target color.

Current US Original Classification (1):
358/1.9

Current US Cross Reference Classification (1):
358/518

Current US Cross Reference Classification (2):
358/520

Current US Cross Reference Classification (3):
358/523

Current US Cross Reference Classification (4):
358/525

CLAIMS:

7. An apparatus according to claim 6, wherein said printer driver includes a reproduction look-up table (LUT) in which for in-gamut colors said reproduction LUT stores the colorimetrically matched color component values.

8. An apparatus according to claim 6, wherein said printer driver includes a reproduction look-up table (LUT) in which for intermediate out-of-gamut colors said reproduction LUT stores a weighted average of perceptually matched color component values and saturation matched color component values.

18. An apparatus for color printing comprising:

a color printer for printing color images in response to color component values, said color printer having a gamut of printable colors;

a color monitor for displaying colors within a gamut of displayable colors;

a processing unit including a computer for executing stored program process steps, said processing unit including a color monitor interface for providing color primary values to said color monitor and a color printer interface for providing color component values to said color printer;

a memory for storing process steps for execution by said processing unit;

said process steps including (a) steps which together comprise an application program for deriving a color image and for displaying and printing the derived color image, (b) steps which together comprise a monitor driver for providing color primary values to said color monitor interface in response to display of the color image by said application program, and (c) steps which together comprise a color printer driver for providing color component values to said color printer interface in response to printing by said application program, said color printer driver including a reproduction look-up table (LUT) which, for each of plural colors both in-gamut and out-of-gamut of the printer, stores color component values for printing by said printer, wherein for out-of-gamut colors said reproduction LUT stores color component values obtained by dual-cone gamut mapping in which an actual cone of N-cone arranged surfaces is defined which mimics the actual gamut of the printer, in which an ideal cone of M-cone arranged surfaces is defined which mimics the gamut of the color monitor, in which a target out-of-gamut color is projected onto the actual cone and de-saturated until in-gamut color component values

are obtained, in which the same target color is projected onto the ideal cone to obtain fully-saturated color component values, and in which a weighted average is obtained of the in-gamut color component values and the fully-saturated color component values, weight being based on a measure of distance between the out-of-gamut target color and its projection onto the actual cone.

☐ 31. Document ID: US 5655062 A

L4: Entry 31 of 38 File: USPT Aug 5, 1997

DOCUMENT-IDENTIFIER: US 5655062 A
TITLE: Accent color printing

Application Filing Date (1):
19950302

Detailed Description Text (4):
The print driver 24 displays a color mapping table, Table 1, via the host computer monitor 11. The user can select a desired mapping from the process colors shown on the monitor (called "Display Color" in table 1) to the accent colors available on the marking engine 20 (called "Printer Color" in table 1) by indicating one of the Printer Colors for each display color using a pointing device such as the keyboard 19, or a mouse (not shown). In response to the user selection, the print driver 24 inserts color mapping parameters representing the selection into the specific page description commands.

Detailed Description Text (16):
If red, green, or blue toners are not available in the marking engine 20, and the display colors are mapped by the user to "Automatic" in the print driver 24, the display colors are represented by the first toner available in red, green, blue, yellow priority order and the percent black formula in Table 2 above is used to calculate the percent of accent color toner to use.

Detailed Description Text (17):
Table 3 and equation (1) above show the default color mapping that takes place in the accent color filter 26 if the user selects "Automatic" for any of the printer colors in the print driver 24 given the different combinations of red, green, blue and yellow toner installed in the marking engine 20. If the user explicitly maps a display color to a particular printer color in the print driver 24, the display color maps to 100% of the printer color.

Current US Original Classification (1):
358/1.9

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Ima

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☐ 32. Document ID: US 5631749 A

L4: Entry 32 of 38 File: USPT May 20, 1997

DOCUMENT-IDENTIFIER: US 5631749 A

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TITLE: Color image signal processing device

Application Filing Date (1):
19951215

Detailed Description Text (3):
FIG. 1 shows the overall structure of a color image signal processing device of an embodiment according to the invention (hereinafter referred to as "the device"). The device converts a color signal of an image for a color CRT display 2 (first device) to reproduce the image signal in a color printer 4 (second device). The device 1 includes a CPU 3 for outputting the color signal of the image to the CRT display 2, a ROM 3A in which a control program for the CPU 3, is stored, a RAM 3B for storing signals to be input to and output from the CPU 3, a CPU 5 for conducting conversion processing on the color signal and outputting the processed color signal to a color printer 4 through a print driver 4A, a ROM 6 in which hue conversion data 6A and conversion programs are stored, and a RAM 7 provided with a hue conversion table 7A and a working area 7B. The CPU 3 is connected to a mouse 8 and a keyboard 9 to input operation commands. The CPU 3 and the CPU 5 are connected to each other through a bus 3C so that they are allowed to communicate therebetween. The CPU 5 is connected to the ROM 6 and the RAM 7. The CPU 5 has various functions, such as a hue calculator 11, a hue conversion table adjustment unit 12 and a color converter 13.

Current US Original Classification (1):
358/520

Current US Cross Reference Classification (1):
358/501

Current US Cross Reference Classification (2):
358/518

Current US Cross Reference Classification (3):
358/523

☐ 33. Document ID: US 5563725 A

L4: Entry 33 of 38 File: USPT Oct 8, 1996

DOCUMENT-IDENTIFIER: US 5563725 A
TITLE: Color image processing apparatus for processing image data based on a display characteristic of a monitor

Application Filing Date (1):
19950119

Detailed Description Text (31):
FIG. 24 is a block diagram schematically showing the detailed structure of the host 110. As shown in FIG. 24, the host 110 is operated by an operating system (not shown: hereinafter referred to as OS) and is provided with device drivers such as a monitor driver 112 to execute an application software (hereinafter referred to application) 111, and operate the monitor controller 140 which is connected to the host 110, and a printer driver 113 to operate the printer controller 120 which is connected to the host 110. The printer driver 113 comprises a command analyzing unit 114 to analyze the commands transferred from the monitor controller 140, a color correction coefficient table storing unit for each monitor 115 to store the color correction information tables in accordance

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with the characteristics of the monitor 150; and a monitor ID address storing unit 116 to store the addresses of the color correction coefficient table for each monitor 115 among others.

Detailed Description Text (45):
FIG. 29 is a view showing the structure of the color correction coefficient table #1 for each monitor stored in the storing unit 115 for the color correction coefficient table for each table of the printer driver 113 of the host 110. As shown in FIG. 29, the color correction coefficient table #1 for each monitor stores the monitor ID character sequence, .gamma. value, input masking coefficient with which to cause the printer to execute the required color correction in accordance with the characteristics of the monitor. According to the present embodiment, the monitor ID character sequence, .gamma. value, input masking coefficient are stored for information regarding the monitor ID0, monitor ID1, monitor ID2, . . . , and monitor IDn in that order in accordance with each model of the (n+1) monitors.

Detailed Description Text (73):
At first, in step S121, a monitor ID character sequence is fetched from the monitor information returning command (FIG. 20B) which has been analyzed in the step S103 in FIG. 34. Then, in step S122, the pointer is set at the head of the color correction coefficient table #1 (FIG. 29) for each monitor stored in the storing unit 115 of the printer driver 113 for the color correction coefficient table for each monitor.

Detailed Description Text (126):
FIG. 47 is a view showing the inner structure of the correction coefficient table #2 for each monitor to be stored in the storing unit 115 of the printer driver 113 for the color correction coefficient table for each monitor. In the color correction coefficient table #2 for each monitor, there are stored the monitor ID character sequences, .gamma. correction values (converted values) .gamma. (n) (n=0 to 255), and input masking coefficients to execute the color correction for a printer in accordance with the characteristics of a monitor. At the head of the table, the information of the monitor ID0 is stored. Then, the monitor ID character sequences, .gamma. correction values (converted values) .gamma. (n) (n=0 to 255), and input masking coefficients are stored in accordance with the respective monitor models for the required number of models (n+1) for the monitor ID1, monitor ID2, . . . , monitor IDn in that order. Of these data, the correction value (converted value) .gamma. (n) (n=0 to 255) set for the monitor ID0 at the head of the table is a correction value of .gamma.=1.0, and the input masking coefficients are the values of a0.sub.11 =1, a0.sub.12 =0, a0.sub.13 =0, a0.sub.21 =0, a0.sub.22 =1, a0.sub.23 =0, a0.sub.31 =0, a0.sub.32 =0, a0.sub.33 =1, namely, the set values at which no color correction process will be executed.

Detailed Description Text (213):
FIG. 62 is a view illustrating the inner structure of the .gamma. correction value provisional storage table to be stored in the color correction information memory 117 of the printer driver 113. In the table, the .gamma. correction value (converted value) {.gamma. (n) (n=0 to 255)} set in the monitor information returning command is stored.

Detailed Description Text (214):
FIG. 63 is a view illustrating the inner structure of the default .gamma. correction value table stored in the color correction information memory 117 of the printer driver 113. As shown in FIG. 63, the .gamma. correction value (converted value) {.gamma. (n) (n=0 to 255)} where .gamma.=1.0 is stored.

Detailed Description Text (228):
At first, in step S900, the pointer is set at the head of the .gamma. correction value provisional storage table to be stored in the color correction information memory 117 of the printer driver 113. In step S801, zero is assigned to the loop variable (n).

Detailed Description Text (234):
At first, in step S1000, the pointer 1 is set at the head of the default .gamma. correction value table stored in the color correction information memory 117 of the printer driver 113. In step S901, the pointer 2 is set at the head of the .gamma. value provisional storage table to be stored in the color correction information memory 117 of

the printer driver 113. Also, in step S1002, zero is assigned to the loop variable (n).

Detailed Description Text (242):
At first, in step S820, the pointer is set at the .gamma. correction value provisional storage table of the color correction information memory 117 of the printer driver 113. Thereafter, the same processes in the steps S192 to S199 in the flowchart shown in FIG. 27 described in conjunction with the second embodiment.

Current US Original Classification (1):
358/518

Current US Cross Reference Classification (2):
358/519

☐ 34. Document ID: US 5510910 A

L4: Entry 34 of 38 File: USPT Apr 23, 1996

DOCUMENT-IDENTIFIER: US 5510910 A
TITLE: Printing with full printer color gamut, through use of gamut superposition in a common perceptual space

Application Filing Date (1):
19940503

Brief Summary Text (13):
Some color-matching technology has been incorporated into printer drivers, and in some such cases partially into accompanying lookup tables. A driver provides a translation interface between--on one hand--a particular computer operating system, and/or application software running in the computer, and on the other hand a color printer which acts as a hardcopy output device.

Current US Original Classification (1):
358/502

Current US Cross Reference Classification (1):
358/520

☐ 35. Document ID: US 5500921 A

L4: Entry 35 of 38 File: USPT Mar 19, 1996

DOCUMENT-IDENTIFIER: US 5500921 A
**** See image for Certificate of Correction ****
TITLE: Method and apparatus for printing high fidelity color reproductions of colors displayed on a monitor

Application Filing Date (1):
19921005

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Current US Original Classification (1):
358/1.9

CLAIMS:

2. A printer driver according to claim 1, wherein the printer table includes transition values between colors within the color printer gamut and colors in the border table.

3. A printer driver according to claim 2, wherein the printer table includes values for colors within the color printer gamut and for colors within a gamut for a color monitor.

4. A printer driver according to claim 3, wherein within the color printer gamut the printer table provides color output values for accurate color reproduction and outside the color printer gamut the printer table provides color output values that preserve color differentiation.

5. A printer driver according to claim 1, wherein the border table is comprised by a wheeled cells centered on the gray axis in the input color coordinate space.

7. A printer driver according to claim 1, wherein the border table provides color output values for colors that are more highly saturated than corresponding colors of the same lightness on the printer gamut edge.

☐ 36. Document ID: US 5438649 A

L4: Entry 36 of 38 File: USPT Aug 1, 1995

DOCUMENT-IDENTIFIER: US 5438649 A
**** See image for Certificate of Correction ****
TITLE: Color printing method and apparatus which compensates for Abney effect

Application Filing Date (1):
19921028

Current US Original Classification (1):
358/1.9

Current US Cross Reference Classification (1):
358/518

CLAIMS:

11. A color printer driver according to claim 10, wherein the hue angles for colors within the color printer gamut are also warped whereby color smoothness for the colors in the printer table is preserved.

17. A color printer driver according to claim 10, further comprising a border table for providing color primary values for colors outside the printer table, and wherein said control means selects the printer table or the border table in accordance with whether the designated color is within the printer table or outside the printer table, and extracts the color primary values from the selected one of the printer table and the border table.

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18. A color printer driver according to claim 17, wherein warping of the printer table is the same as warping of the border table.

19. A color printer driver according to claim 17, wherein the border table is arranged in a wheel-like arrangement of cells centered on the lightness axis.

☑ 37. Document ID: US 5408342 A

L4: Entry 37 of 38 File: USPT Apr 18, 1995

DOCUMENT-IDENTIFIER: US 5408342 A
**** See image for Certificate of Correction ****
TITLE: Color image processing apparatus, method, and printer driver

Application Filing Date (1):
19930225

Detailed Description Text (31):
FIG. 24 is a block diagram schematically showing the detailed structure of the host 110. As shown in FIG. 24, the host 110 is operated by an operating system (not shown: hereinafter referred to as OS) and is provided with device drivers such as a monitor driver 112 to execute an application software (hereinafter referred to application) 111, and operate the monitor controller 140 which is connected to the host 110, and a printer driver 113 to operate the printer controller 120 which is connected to the host 110. The printer driver 113 comprises a command analyzing unit 114 to analyze the commands transferred from the monitor controller 140, a color correction coefficient table storing unit for each monitor 115 to store the color correction information tables in accordance with the characteristics of the monitor 150; and a monitor ID address storing unit 116 to store the addresses of the color correction coefficient table for each monitor 115 among others.

Detailed Description Text (45):
FIG. 29 is a view showing the structure of the color correction coefficient table #1 for each monitor stored in the storing unit 115 for the color correction coefficient table for each table of the printer driver 113 of the host 110. As shown in FIG. 29, the color correction coefficient table #1 for each monitor stores the monitor ID character sequence, .gamma. value, input masking coefficient with which to cause the printer to execute the required color correction in accordance with the characteristics of the monitor. According to the present embodiment, the monitor ID character sequence, .gamma. value, input masking coefficient are stored for information regarding the monitor ID0, monitor ID1, monitor ID2, . . . , and monitor IDn in that order in accordance with each model of the (n+1) monitors.

Detailed Description Text (73):
At first, in step S121, a monitor ID character sequence is fetched from the monitor information returning command (FIG. 20B) which has been analyzed in the step S103 in FIG. 34. Then, in step S122, the pointer is set at the head of the color correction coefficient table #1 (FIG. 29) for each monitor stored in the storing unit 115 of the printer driver 113 for the color correction coefficient table for each monitor.

Detailed Description Text (124):
FIG. 47 is a view showing the inner structure of the correction coefficient table #2 for each monitor to be stored in the storing unit 115 of the printer driver 113 for the color correction coefficient table for each monitor. In the color correction coefficient table

#2 for each monitor, there are stored the monitor ID character sequences, .gamma. correction values (converted values) .gamma. (n) (n=0 to 255), and input masking coefficients to execute the color correction for a printer in accordance with the characteristics of a monitor. At the head of the table, the information of the monitor ID0 is stored. Then, the monitor ID character sequences, .gamma. correction values (converted values) .gamma. (n) (n=0 to 255), and input masking coefficients are stored in accordance with the respective monitor models for the required number of models (n+1) for the monitor ID1, monitor ID2, . . . , monitor IDn in that order. Of these data, the correction value (converted value) .gamma. (n) (n=0 to 255) set for the monitor ID0 at the head of the table is a correction value of .gamma.=1.0, and the input masking coefficients are the values of a0.sub.11 =1, a0.sub.12 =0, a0.sub.13 =0, a0.sub.21 =0, a0.sub.22 =1, a0.sub.23 =0, a0.sub.31 =0, a0.sub.32 =0, a0.sub.33 =1, namely, the set values at which no color correction process will be executed.

Detailed Description Text (211):
FIG. 62 is a view illustrating the inner structure of the .gamma. correction value provisional storage table to be stored in the color correction information memory 117 of the printer driver 113. In the table, the .gamma. correction value (converted value) {.gamma. (n) (n=0 to 255)} set in the monitor information returning command is stored.

Detailed Description Text (212):
FIG. 63 is a view illustrating the inner structure of the default .gamma. correction value table stored in the color correction information memory 117 of the printer driver 113. As shown in FIG. 63, the .gamma. correction value (converted value) {.gamma. (n) (n=0 to 255)} where .gamma.=1.0 is stored.

Detailed Description Text (225):
At first, in step S900, the pointer is set at the head of the .gamma. correction value provisional storage table to be stored in the color correction information memory 117 of the printer driver 113. In step S801, zero is assigned to the loop variable (n).

Detailed Description Text (231):
At first, in step S1000, the pointer 1 is set at the head of the default .gamma. correction value table stored in the color correction information memory 117 of the printer driver 113. In step S901, the pointer 2 is set at the head of the .gamma. value provisional storage table to be stored in the color correction information memory 117 of the printer driver 113. Also, in step S1002, zero is assigned to the loop variable (n).

Detailed Description Text (239):
At first, in step S820, the pointer is set at the .gamma. correction value provisional storage table of the color correction information memory 117 of the printer driver 113. Thereafter, the same processes in the steps S192 to S199 in the flowchart shown in FIG. 27 described in conjunction with the second embodiment.

Current US Original Classification (1):
358/518

Current US Cross Reference Classification (1):
358/519

☐ 38. Document ID: US 5299291 A

L4: Entry 38 of 38 File: USPT Mar 29, 1994

DOCUMENT-IDENTIFIER: US 5299291 A
TITLE: Color printing method and apparatus using an out-of-gamut color table

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Application Filing Date (1):
19921028

Current US Original Classification (1):
358/1.9

Current US Cross Reference Classification (1):
358/518

CLAIMS:

6. A color printer driver according to claim 5, wherein the printer table includes color primary values for colors within a color monitor gamut.

7. A color printer driver according to claim 5, wherein for colors within the color printer gamut, the color primary values in the printer table are provided in accurate correspondence to the associated colors.

8. A color printer driver according to claim 5, wherein the color primary values for colors in the printer table outside the printer gamut are provided so as to preserve hue, increase saturation, and change lightness.

9. A color printer driver according to claim 5, further comprising a border table for providing color primary values for colors outside the printer table, wherein said control means selects the printer table or the border table based on the designated color and extracts color primary values from the selected one of the printer table and the border table.

10. A color printer driver according to claim 9, wherein the border table is arranged in a wheel-like arrangement of cells centered on the lightness axis.

11. A color printer driver according to claim 9, wherein the color primary values for colors in the border table outside the printer gamut are provided so as to preserve hue, increase saturation, and change lightness.

Term	Documents
(2 AND 3 AND 1).PGPB,USPT,EPAB,JPAB,DWPI,TDBD.	38
(L1 AND L2 AND L3).PGPB,USPT,EPAB,JPAB,DWPI,TDBD.	38

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